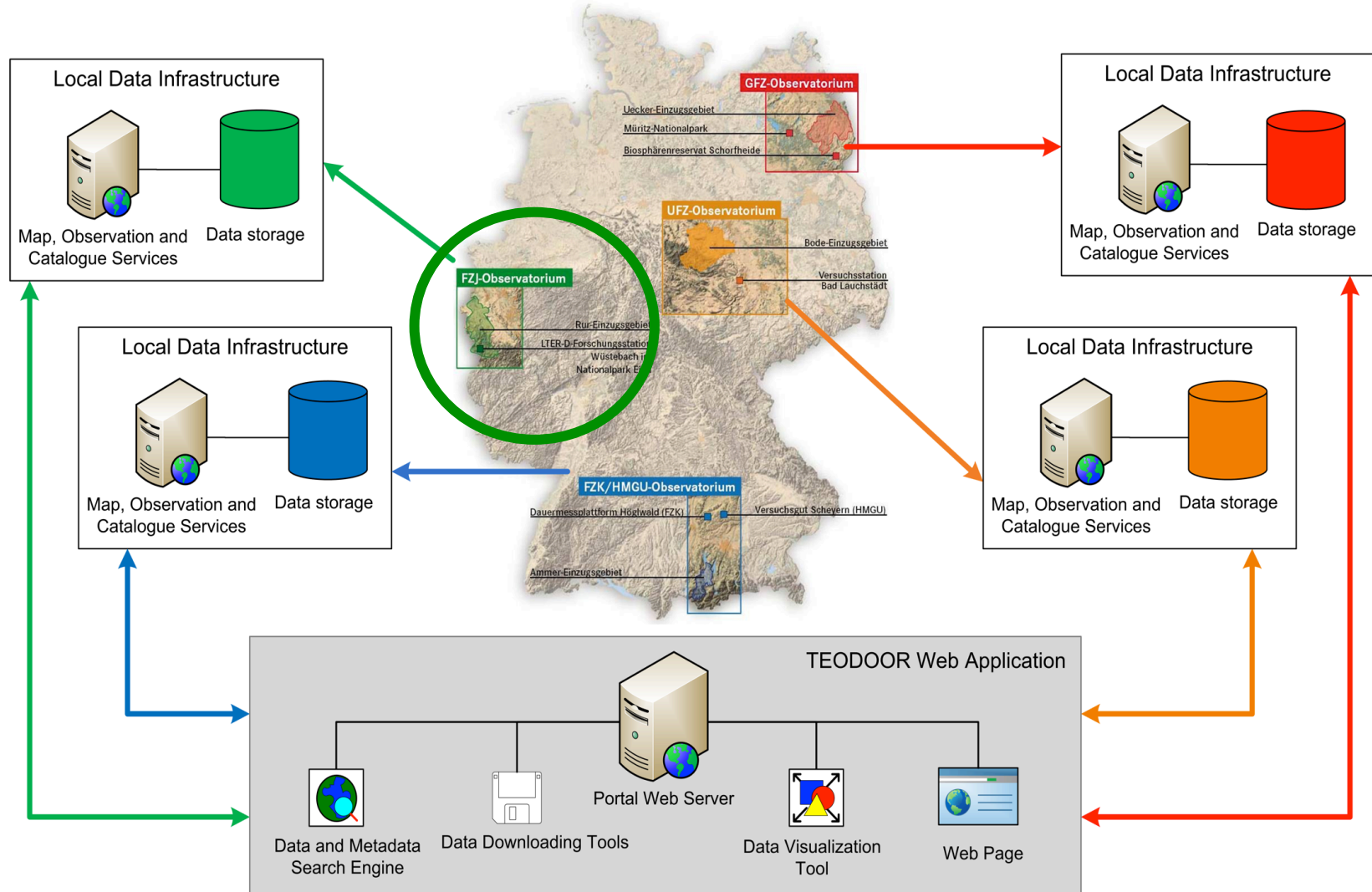


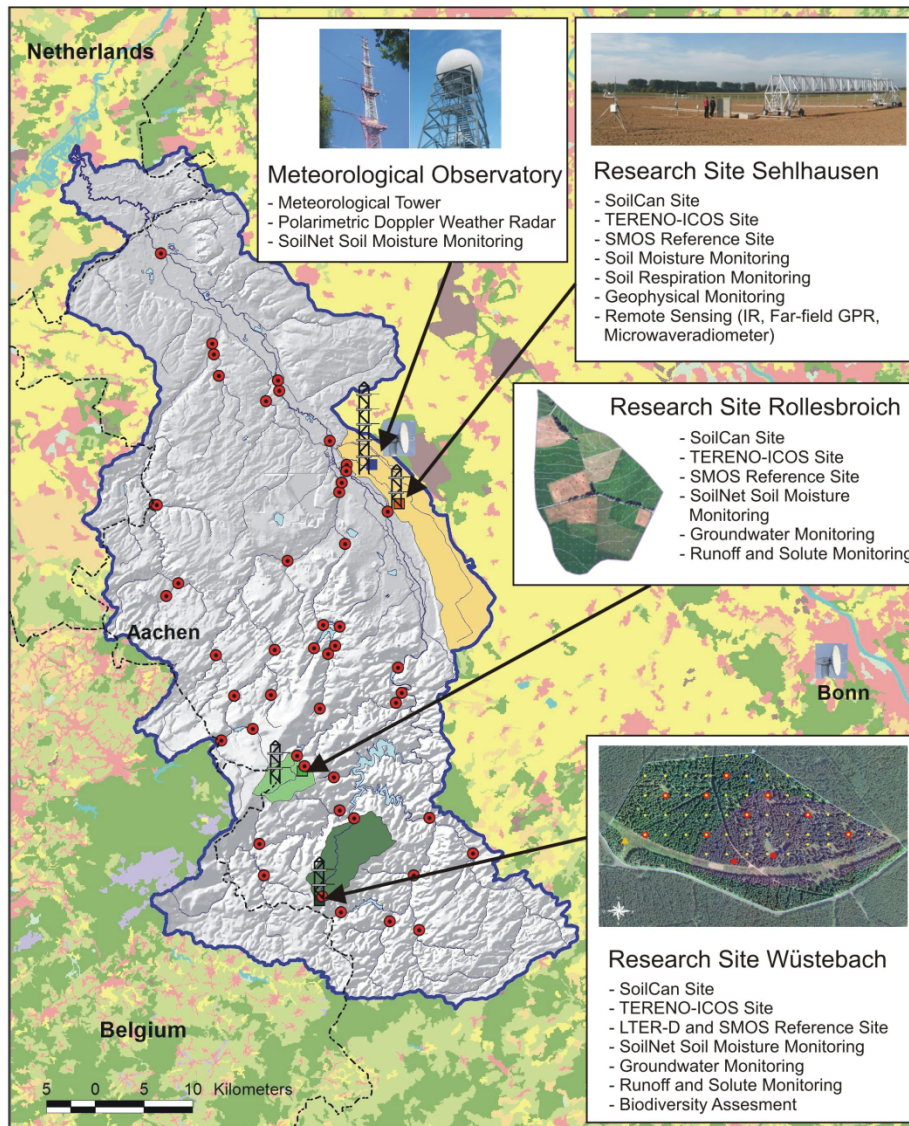
Incorporating Quality Control Information into the Sensor Web

21 November 2013 | Anusuriya Devaraju, Ralf Kunkel, Juergen Sorg

TERENO Observatories



Sensors Managed by FZJ

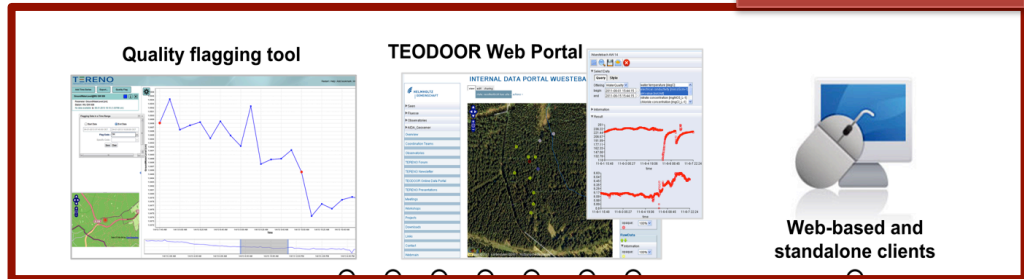


- Rur Hydrological Observatory
- Ellebach Subbasin
- Kall Subbasin
- Erkersruhr Subbasin
- Waterbodies
- Runoff gauging station
- Eddy flux tower
- Weather Radar

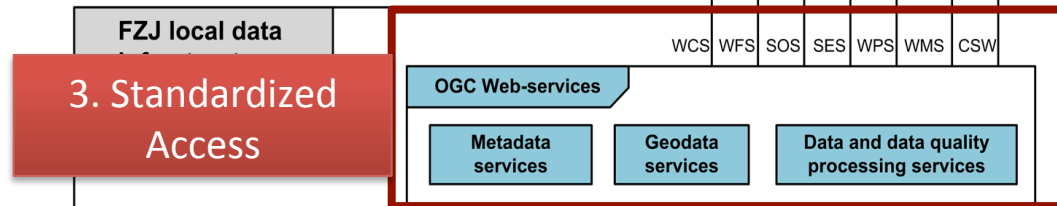


TERENO Data Infrastructure

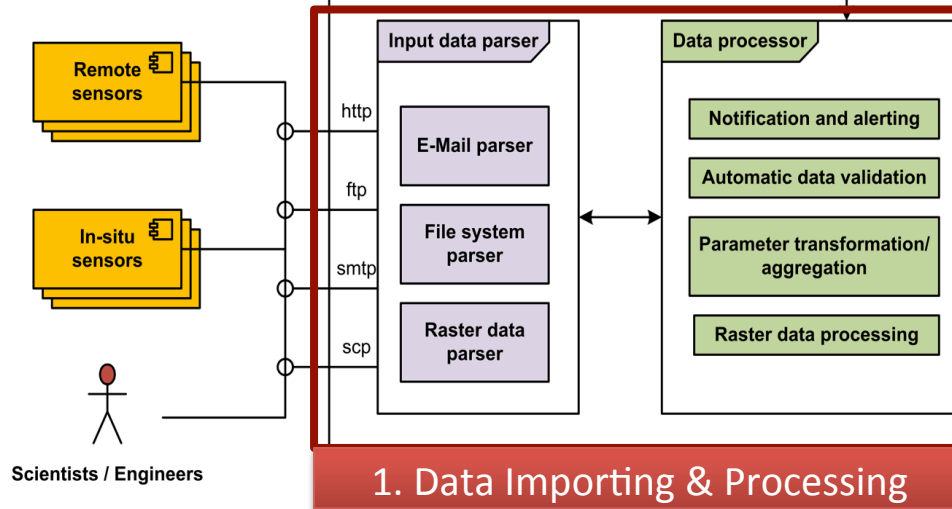
4. Publication



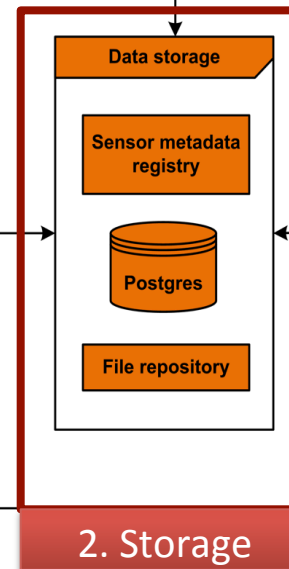
3. Standardized Access



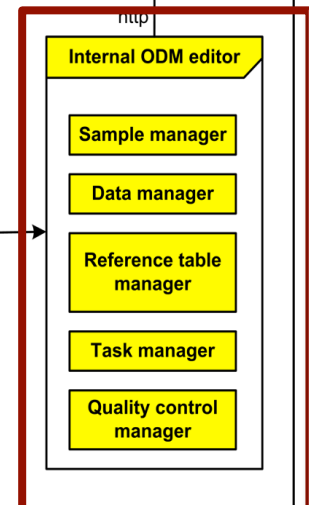
1. Data Importing & Processing



2. Storage



5. Administration

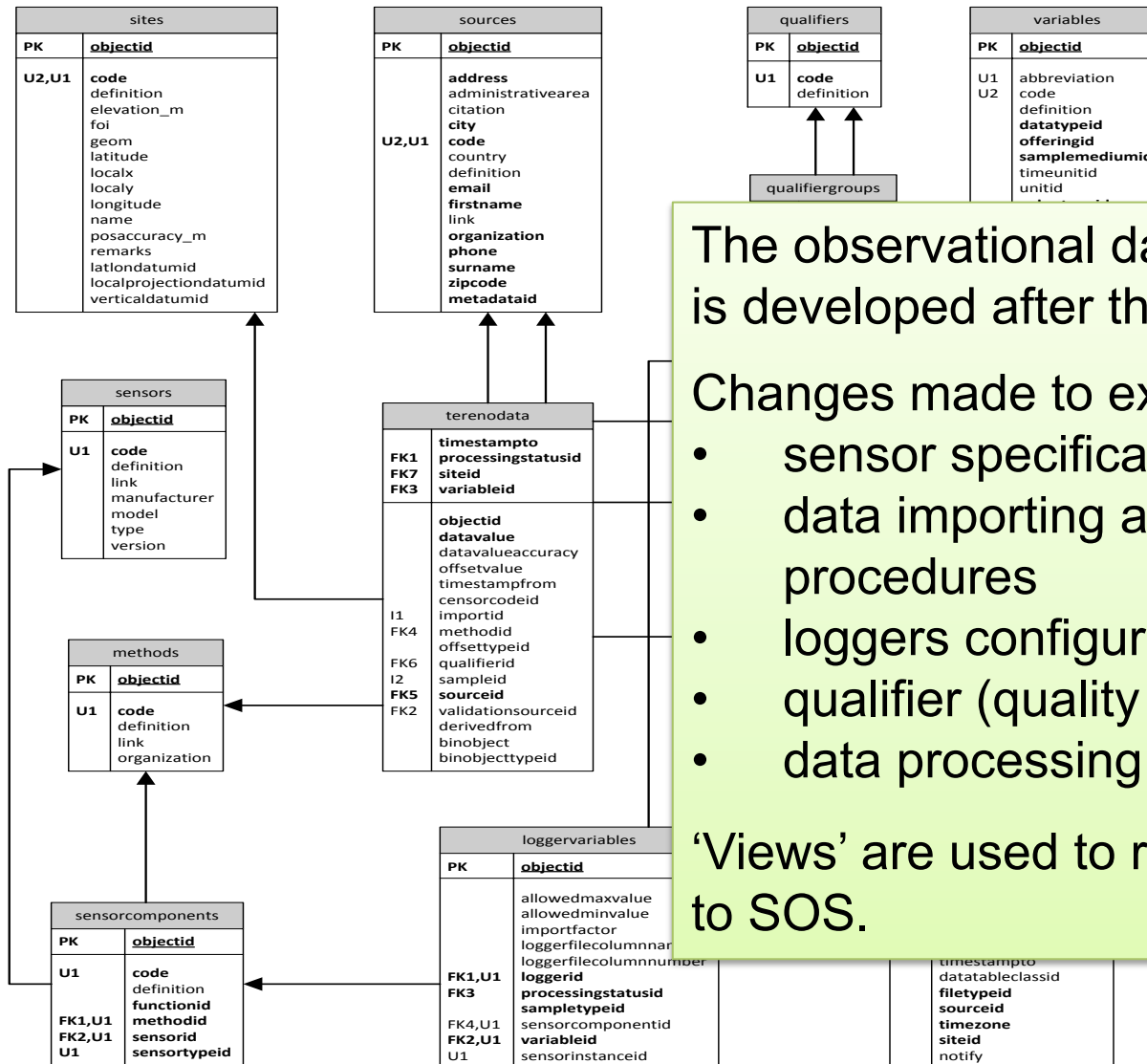


TERENO Data Portal : <http://teodoor.icg.kfa-juelich.de>

How can we represent and publish Quality Control (QC) information of TERENO observations?

1. Observational data model ✓
2. Sensor Observation Service (SOS)
3. Quality flagging tool

1. Observational Data Model



The observational data model of TERENO is developed after the CUAHSI ODM.

Changes made to existing ODM:

- sensor specifications
- data importing and transformation procedures
- loggers configurations
- qualifier (quality flags)
- data processing level ...

‘Views’ are used to relate our data model to SOS.

NEW

How can we represent and publish Quality Control (QC) information of TERENO observations?

1. Observational data model
2. Sensor Observation Service (SOS) ✓
3. Quality flagging tool

2. Customized Sensor Observation Service (SOS)

```
<om:ObservationCollection xmlns:om="http://www.opengis.net/om/1.0" xmlns:gml="http://www.opengis.net/gml">
  <gml:metaDataProperty>
    <swe:DataArray>
      <swe:elementCount>
        <swe:Count>
          <swe:value>15</swe:value>
        </swe:Count>
      </swe:elementCount>
      <swe:elementType name="Components">
        <swe:SimpleDataRecord>
          <swe:field name="Id"/>
          <swe:field name="GenericQualifier"/>
          <swe:field name="SpecificQualifier"/>
        </swe:SimpleDataRecord>
      </swe:elementType>
      <swe:encoding>
        <swe:TextBlock decimalSeparator="." tokenSeparator="," blockSeparator=";" />
      </swe:encoding>
      <swe:values>13,bad,outofrange;15,bad,irregular;18,bad,isolatedspike;6,bad,maxerror;5,bad,minerror;
12,suspicious,unknownqcsource;17,suspicious,maxerror;16,suspicious,minerror;9,missing,missingdata;
4,gapfilled,extrapolated;3,gapfilled,interpolated;2,ok,ok;10,1,unevaluated,unevaluated</swe:values>
    </swe:DataArray>
  </gml:metaDataProperty>
  <gml:metaDataProperty>
    <swe:DataArray>
      <swe:elementCount>
        <swe:Count>
          <swe:value>4</swe:value>
        </swe:Count>
      </swe:elementCount>
      <swe:elementType name="Components">
        <swe:SimpleDataRecord>
          <swe:field name="Id"/>
          <swe:field name="ProcessingStatus"/>
        </swe:SimpleDataRecord>
      </swe:elementType>
      <swe:encoding>
        <swe:TextBlock decimalSeparator="." tokenSeparator="," blockSeparator=";" />
      </swe:encoding>
      <swe:values>1,Level1;2,Level2a;3,Level2b;4,Level2c;5,Level3</swe:values>
    </swe:DataArray>
  </gml:metaDataProperty>
  <om:result>
    <swe:DataArray>
      <swe:elementCount>
        <swe:Count>
          <swe:value>13401</swe:value>
        </swe:Count>
      </swe:elementCount>
      <swe:elementType name="Components">
        <swe:SimpleDataRecord>
          <swe:field name="Time">
            <swe:Time definition="urn:ogc:data:time:iso8601"/>
          </swe:field>
          <swe:field name="feature">
            <swe:Text definition="urn:ogc:data:feature"/>
          </swe:field>
          <swe:field name="SensorVoltageBattery">
            <swe:Quantity definition="SensorVoltageBattery">
              <swe:uom code="V"/>
            </swe:Quantity>
          </swe:field>
          <swe:field name="SensorVoltageBatteryQualityFlag">
            <swe:Category definition="SensorVoltageBatteryQualityFlag"/>
          </swe:field>
        </swe:SimpleDataRecord>
      </swe:elementType>
      <swe:encoding>
        <swe:TextBlock decimalSeparator="." tokenSeparator="," blockSeparator=";" />
      </swe:encoding>
      <swe:values>2011-02-01T17:00:00.000+01:00,WU_CR_001,11.699999999999999,2_2;
2011-02-01T18:00:00.000+01:00,WU_CR_001,11.699999999999999,2_2;
2011-02-01T19:00:00.000+01:00,WU_CR_001,11.699999999999999,2_2;2011-02-01T20:00:00.000+01:00,WU
    </swe:DataArray>
  </om:result>
</om:Observation>
```

Quality Flags are represented in the order of flag id, generic flag and specific flag

Data processing levels

Each observed value is accompanied with a reference combining a data level id and a flag id.

```
sos.config
File Path: ~/Tomcat/webapps/ibg3sosV311/WEB-INF/conf/sos.config
101 ### no data value ###
102 NODATAVALUE=noData
103
104 #####character encoding for response documents#####
105 CHARACTERENCODING=UTF-8
106
107 ### prefix URN for the spatial reference system #####
108 SRS_NAME_PREFIX=urn:ogc:def:crs:EPSG
109
110 ### capabilitiesCacheController implementation (CapabilitiesCacheController)
111 CAPABILITIESCACHECONTROLLER=org.n52.sos.cache.CapabilitiesCacheController
112
113 ### capabilitiesCacheUpdateInterval (0 = no automatic update!)
114 CAPABILITIESCACHEUPDATEINTERVAL=5
115
116 ##### ibg-3 customization #####
117 # quality flag within observation table (field string_value)
118 SUPPORTS_ODM_QUALITY=true
119
120
```


How can we represent and publish Quality Control (QC) information of TERENO observations?

1. Observational data model
2. Sensor Observation Service (SOS)
3. Quality flagging tool ✓

3. Quality Flagging Tool

T=RENO
TERRESTRIAL ENVIRONMENTAL OBSERVATORIES

AnusuriyaDevaraju | Help | Add bookmark | Imprint

Add Time Series Export Series Data Quality Flagging

SoilTemperature0.05mSensor1@RO B 074

SoilTemperature0.05mSensor1@RO B 096

Parameter: SoilTemperature0.05mSensor1 [degC]
Station: RO B 096
05.05.2011 13:54 to 02.04.2012 00:00

nsor1 (degC)

Search for time series

Point Flagging Range Flagging View-based Flagging Customize Flags

Start Date End Date

2012-04-01 13:54:07+0200 2012-04-01 20:59:08+0200

Flag Code:

Specific Code:

gapfilled
baddata
suspicious
unevaluated
ok

Add Flag

01/04/2

◆ gapfi

Search for time series

Point Flagging Range Flagging View-based Flagging Customize Flags

Series Sensor Property

RO_B_074 SoilTemperature0.05mSensor1

RO_B_096 SoilTemperature0.05mSensor1

Click on a particular 'Series Shape' to modify the value.

Flag Type Series Shape Example

unevaluated cross

suspicious triangleup

ok filledsquare

gapfilled diamond

baddata triangledown

Update Series Reset All

Start: 2012-04-01 09:06:48+0200
End: 2012-04-01 23:02:01+0200
☐ Assign 'OK' flag to selected time series.

Series Sensor Property

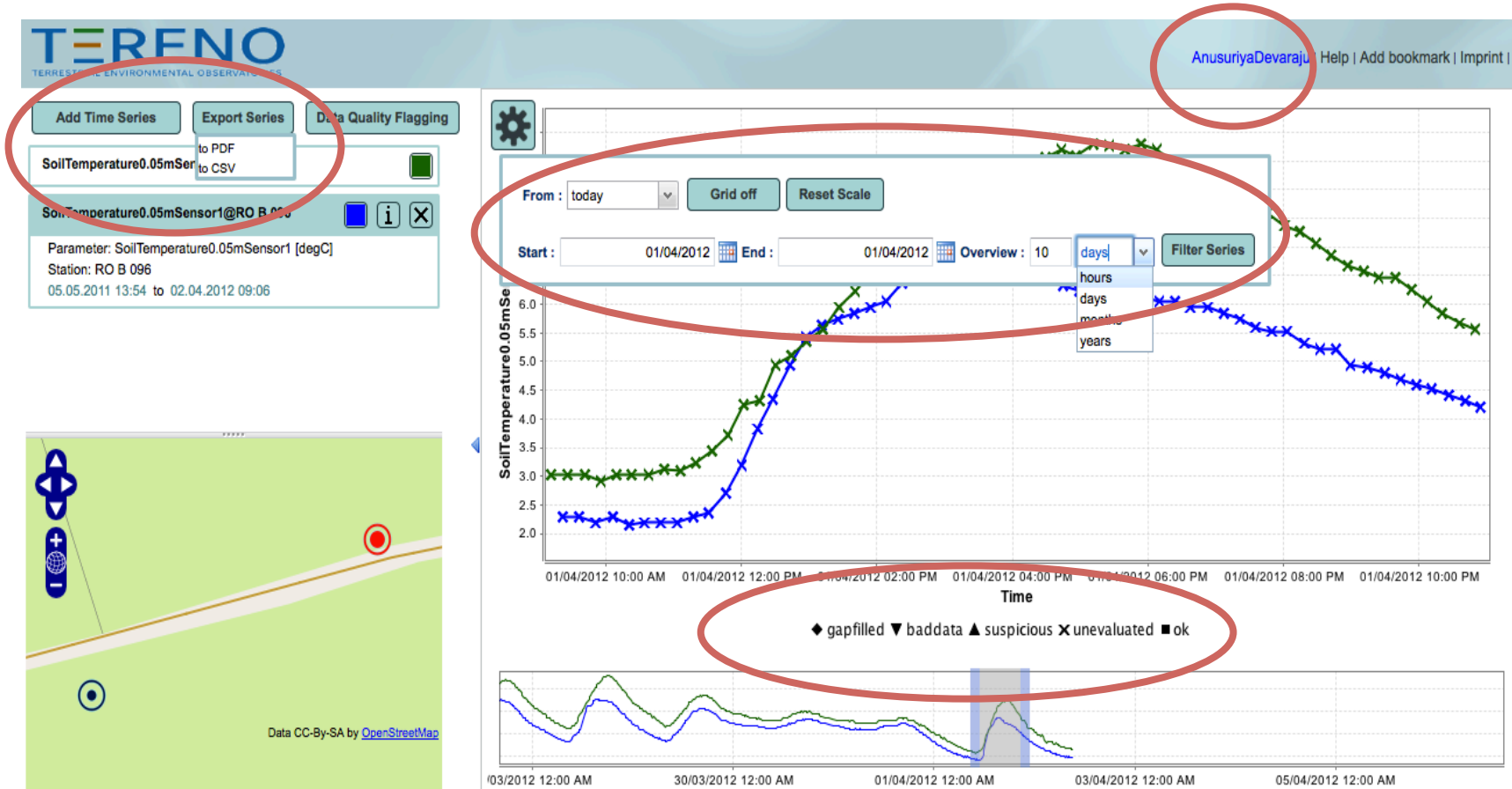
RO_B_074 SoilTemperature0.05mSensor1

RO_B_096 SoilTemperature0.05mSensor1

Add Flag Clear

30/03/2012 12:00 AM

3. Quality Flagging Tool



Thank You...



We are buried in data,
while what we really need is a
well-documented & quality controlled data!